

Listing of Claims

Claims (1-23): Canceled

Claim 24 (Previously Presented): A device for setting up virtual circuits between a first end system and a second end system, said virtual circuits being set up on a network connecting said first end system to said second end system, wherein said first end system is a first ATM switch, said second end system is a second ATM switch, and said network is an ATM network, said device comprising:

an outbound interface coupled to said ATM network;

a message construction block coupled to said outbound interface;

a call control logic to cause said message construction block to construct a first signaling message requesting a first plurality of virtual circuits to be set up, and to send said first signaling message on said network to said second end system;

wherein said first signaling message is a single signaling message, wherein said single signaling message comprises a plurality of information elements, wherein a first information element is designed to request set up of a single virtual circuit comprised in said first plurality of virtual circuits, and a second information element in the form of a non-mandatory information element according to a signaling specification used in said ATM network is designed to request set up of a second virtual circuit comprised in said first plurality of virtual circuits;

an inbound interface designed for receiving on said ATM network a first acceptance message indicating that only said single virtual circuit is set up if any of a plurality of switches in a connection path between said first end system and said second end system is designed not to support processing of said non-mandatory information element, wherein said first acceptance message is received in response to sending said first information element contained in said signaling message to said second end system; and

a parser designed for examining said first acceptance message and forwarding said first acceptance message to said call control logic.

Claim 25 (Previously Presented): The device of claim 24, further comprising a signaling application programming interface (API), said signaling API receiving a request for a group of virtual circuits from an external application, and communicating said request

to said call control logic, wherein said call control logic causes said single signaling message to be sent in response to said request.

Claim 26 (Previously Presented): The device of claim 25, wherein said outbound interface sends said single signaling message in the form of a plurality of asynchronous transfer mode (ATM) cells, said device further comprising:

a signaling ATM adaptation layer (SAAL) output block to encapsulate data generated by said message construction block to generate said single signaling message, said SAAL output block being coupled to said outbound interface.

Claim 27 (Canceled)

Claim 28 (Previously Presented): The device of claim 24, wherein said first information element comprises a mandatory information element according to said signaling specification used for signaling in said ATM network.

Claim 29 (Previously Presented): The device of claim 24, wherein said signaling specification comprises one of user to network interface (UNI) or network to network interface (NNI).

Claim 30 (Previously Presented): The device of claim 24, wherein said call control logic causes said message construction block to send a second signaling message as said single signaling message requesting set up of a second plurality of virtual circuits, wherein said inbound interface designed for receiving a second acceptance message also as a single message, said second acceptance message indicating that said plurality of switches in a connection path between said first ATM switch and said second ATM switch have set up said second plurality of virtual circuits, said second acceptance message being received in response to said second signaling message if all of said plurality of switches in said connection path are designed to support processing of said non-mandatory information element according to said signaling specification .

Claim 31 (Previously Presented): The device of claim 24, wherein said plurality of switches accept said second plurality of virtual circuits but immediately provision fewer than said second plurality of virtual circuits between said first end system and said second end system,

wherein the specific ones of said second plurality of virtual circuits accepted but not provisioned form a set of inactive virtual circuits,

wherein said call control logic is designed to cause said message construction block to send a third signaling message to activate at least one of said set of inactive virtual circuits between said first end system and said second end system.

Claim 32 (Previously Presented): The device of claim 30, wherein said second plurality of virtual circuits is treated as a group of virtual circuits, wherein said first ATM switch and said second ATM switch support a plurality of groups including said group, said device further comprising a memory designed for storing a bundle structure associated with each of said plurality of groups, wherein said bundle structure stores information identifying the specific plurality of virtual circuits forming the corresponding group.

Claim 33 (Previously Presented): The device of claim 32, wherein said memory is designed to further store a plurality of call reference structures and a plurality of per_VC structures,

wherein each of said plurality of call reference structures maintains the state of a call, wherein signaling messages related to each group are received on a corresponding call, and

wherein each per_VC structure stores information related to a plurality of call parameters accepted for a corresponding one of said plurality of virtual circuits.

Claim 34 (Previously Presented): The device of claim 33, wherein said device comprises a switch in said connection path, said memory is further designed for storing a plurality of switch structures, wherein each of said plurality of switch structures stores a mapping of an identifier of each of said virtual circuit in inbound direction to another identifier of the virtual circuit in outbound direction.

Claim 35 (Previously Presented): The device of claim 33, wherein said first ATM switch comprises an edge router, wherein said single signaling message contains a bundle identifier which is propagated without translation by each of said plurality of switches.

Claim 36 (Previously Presented): The device of claim 30, wherein said acceptance message and said single signaling message are both formed according to a common format, wherein said common format contains a field which indicates whether a message comprises said acceptance message or said single signaling message.

Claim 37 (Previously Presented): The device of claim 36, wherein said format allows a range of virtual circuits to be specified, said format further allowing a plurality of traffic parameters to be specified for all of said range of virtual circuits, wherein said plurality of parameters in said single signaling message specify the desired parameters and said plurality of parameters in said acceptance message specify the accepted parameters.

Claims 38-78: (Canceled)

Claim 79 (Currently Amended): A method of setting up virtual circuits between a first asynchronous transfer mode (ATM) switch and a second ATM switch, said plurality of virtual circuits being set up on a ATM network connecting said first ATM switch to said second ATM switch, said method being performed in said first ATM switch, said method comprising:

- sending on said ATM network to said second ATM switch a single signaling message requesting a plurality of virtual circuits to be set up between said first ATM switch and said second ATM switch;

- receiving an acceptance message in response to sending said single signaling message, said acceptance message indicating that a plurality of ATM switches in a connection path between said first ATM switch and said second ATM switch have set up said plurality of virtual circuits in response to said single signaling message,

- wherein said plurality of ATM switches accept said plurality of virtual circuits but immediately provision fewer than said plurality of virtual circuits between said first ATM switch and said second ATM switch,

wherein the specific ones of said plurality of virtual circuits accepted but not provisioned form a set of inactive virtual circuits which cannot be used for transporting packets until provisioning is complete; and

sending a second signaling message from said first ATM switch to said second ATM switch to complete provisioning of at least one of said set of inactive virtual circuits between said first ATM switch and said second ATM switch,

wherein said acceptance message is received only if each of said plurality of ATM switches is designed to support set up of said plurality of virtual circuits in response to said single signaling message.

wherein said single signaling message comprises a plurality of information elements, wherein a first information element is designed to request set up of a single virtual circuit comprised in said plurality of virtual circuits, and a second information element is designed to request set up of one or more virtual circuits comprised in said plurality of virtual circuits,

receiving another acceptance message indicating that only said single virtual circuit is provisioned if any of said plurality of switches in said connection path is designed not to support set up of said plurality of virtual circuits in response to said single signaling message,

wherein said second information element comprises a non-mandatory information element and said first information element comprises a mandatory information element according to a signaling specification used for signaling in said ATM network, wherein non-mandatory information elements can be ignored by said plurality of switches according to said signaling specification.

Claims 80 - 81 (Canceled)

Claim 82 (Currently Amended): The method of claim ~~79~~ 81, wherein said signaling specification comprises one of user to network interface (UNI) or network to network interface (NNI).

Claims 83 - 84 (Canceled)

Claim 85 (Previously Presented): The method of claim 79, wherein said fewer than said plurality of virtual circuits corresponds to one virtual circuit such that only one virtual

circuit is provisioned in response to said single signaling message even when said plurality of switches have set up said plurality of virtual circuits in response to said single signaling message and said acceptance message is received by said first ATM switch.

Claim 86 (Previously Presented): The method of claim 85, wherein said sending is performed from one of said first ATM system or said plurality of ATM switches.

Claim 87(Previously Presented): The method of claim 79, wherein said plurality of virtual circuits is treated as a group of virtual circuits, wherein said first ATM switch and said second ATM switch support a plurality of groups including said group, said method further comprising maintaining a bundle structure associated with each of said plurality of groups, wherein said bundle structure stores information identifying the specific plurality of virtual circuits forming the corresponding group.

Claim 88 (Previously Presented): The method of claim 87, further comprising:
maintaining a plurality of call reference structures, wherein each of said plurality of call reference structures maintains the state of a call, wherein signaling messages related to each group are received on a corresponding call; and
maintaining a plurality of per-VC structures, wherein each per-VC structure stores information related to a plurality of call parameters accepted for a corresponding one of said plurality of virtual circuits.

Claim 89 (Previously Presented): The method of claim 88, wherein said sending, said receiving and each of said maintaining are performed in a switch contained in said connection path, said method further comprising:

maintaining a plurality of switch structures, wherein each of said plurality of switch structures stores a mapping of an identifier of each of said virtual circuit in inbound direction to another identifier of the virtual circuit in outbound direction;

mapping each identifier received in inbound direction to a corresponding identifier in outbound direction using said plurality of switch structures.

Claim 90 (Previously Presented): The method of claim 89, wherein said first ATM switch comprises an edge router and wherein said method is performed in said edge router, wherein said single signaling message contains a bundle identifier which is propagated without translation by each of said plurality of switches.

Claim 91 (Previously Presented): The method of claim 90, wherein each of said plurality of virtual circuits comprises a switched virtual circuit.

Claim 92 (Previously Presented): The method of claim 79, wherein said acceptance message and said single signaling message are both formed according to a common format, wherein said common format contains a field which indicates whether a message comprises said acceptance message or said single signaling message.

Claim 93 (Previously Presented): The method of claim 92, wherein said format allows a range of virtual circuits to be specified, said format further allowing a plurality of traffic parameters to be specified for all of said range of virtual circuits, wherein said plurality of parameters in said single signaling message specify the desired parameters and said plurality of parameters in said acceptance message specify the accepted parameters.

Claim 94 (Previously Presented): The method of claim 93, further comprising sending a release message requesting release of another range of virtual circuits.

Claim 95 (Previously Presented): A method of supporting the setting up of virtual circuits between a first ATM switch and a second ATM switch, said virtual circuits being set up on a ATM network connecting said first ATM switch to said second ATM switch, each of said plurality of virtual circuits terminating at said first ATM switch and said second ATM switch, said method being performed in a device, said method comprising:

receiving from said first ATM switch on said ATM network a single signaling request requesting a plurality of virtual circuits to be set up between said first ATM switch and said second ATM switch;

sending an acceptance message as a response to said single signaling request, said acceptance message indicating that said plurality of virtual circuits are set up if said plurality

of virtual circuits can be set up between said device and said second ATM switch in response to said single signaling request alone; and

provisioning in said device fewer than said plurality of virtual circuits to said second ATM switch,

wherein the specific ones of said plurality of virtual circuits which are set up but not provisioned form a set of inactive virtual circuits which cannot be used to transport packets until provisioning is completed.

Claims 96 - 98 (Canceled)

Claim 99 (Previously Presented): The method of claim 95, said method further comprising:

receiving a second signaling message requesting activation of at least one of said set of inactive virtual circuits between said first ATM switch and said second ATM switch;

completing provisioning of said at least one of said set of inactive virtual circuits to said second ATM switch in response to receiving said second signaling message; and

sending a completion message in response to said second signaling message, said completion message indicating said at least one of said set of inactive virtual circuits have been provisioned.

Claim 100 (Previously Presented): The method of claim 99, wherein said single signaling request contains a plurality of parameters related to a range of virtual circuits comprised in said plurality of virtual circuits, said method further comprising:

storing said plurality of parameters associated with said range of virtual circuits; and

provisioning said range of virtual circuits using said plurality of parameters,

whereby said plurality of parameters are transmitted only once for provisioning said range of virtual circuits.

Claim 101 (Previously Presented): The method of claim 100, wherein said single signaling request and said second signaling message are received in the form of ATM cells.

Claim 102 (Currently Amended): The method of claim 101, wherein said device is ~~comprises one of said first ATM switch, said second ATM switch, or a switch in the path of~~ said plurality of virtual circuits connecting said first ATM switch to said second ATM switch.

Claim 103 (Previously Presented): An apparatus for supporting the setting up of virtual circuits between a first ATM switch and a second ATM switch, said virtual circuits being set up on a ATM network connecting said first ATM switch to said second ATM switch, said plurality of virtual circuits terminating at said first ATM switch and said second ATM switch, said apparatus comprising:

an in-bound interface for receiving from said first ATM switch on said ATM network a single signaling request requesting a plurality of virtual circuits to be set up to said second ATM switch;

a call control logic for receiving said single signaling message, said call control logic sending an acceptance message if said plurality of virtual circuits can be set up between a device containing said apparatus and said second ATM switch in response to said single signaling request alone,

wherein said acceptance message is sent as a response to said single signaling message,

wherein said call control logic is for provisioning fewer than said plurality of virtual circuits to said second ATM switch before sending said acceptance message,

wherein the specific ones of said plurality of virtual circuits which are set up but not provisioned form a set of inactive virtual circuits which cannot be used for transporting packets until provisioning is completed.

Claims 104 - 106 (Canceled)

Claim 107 (Previously Presented): The apparatus of claim 103, wherein said inbound interface is designed to receive a second signaling message requesting activation of at least one of said set of inactive virtual circuits to said second ATM switch, wherein said call control logic is configured to complete provisioning of said at least one of said set of inactive virtual circuits to said second ATM switch and then to send a completion message indicating said at least one of said set of inactive virtual circuits has been activated.

Claim 108 (Previously Presented): The apparatus of claim 107, wherein said single signaling message contains a plurality of parameters related to a range of virtual circuits comprised in said plurality of virtual circuits, said apparatus further comprising a memory storing said plurality of parameters associated with said range of virtual circuits, wherein said call control logic is for provisioning said range of virtual circuits using said plurality of parameters, whereby said plurality of parameters are transmitted only once for provisioning said range of virtual circuits.

Claim 109 (Currently Amended): The apparatus of claim 108, wherein the apparatus is contained in comprising one of said first ATM switch, said second ATM switch or a switch in the path of said plurality of virtual circuits connecting said first ATM switch to said second ATM switch.

Claim 110 (Previously Presented): A device for setting up virtual circuits between a first ATM switch and a second ATM switch, said plurality of virtual circuits being set up on a ATM network connecting said first ATM switch to said second ATM switch, said plurality of virtual circuits terminating at said first ATM switch and said second ATM switch, said device being located in a communication path between said first ATM switch and said second ATM switch, said device comprising:

means for sending on said ATM network to said second ATM switch a single signaling message requesting a plurality of virtual circuits to be set up, wherein said single signaling message comprises a plurality of information elements, wherein a first information element is designed to request set up of a single virtual circuit comprised in said plurality of virtual circuits, and a second information element in the form of a non-mandatory information element according to a signaling specification used in said ATM network is designed to request set up of a second plurality of virtual circuits comprised in said plurality of virtual circuits; and

means for receiving an acceptance message in response to sending said single signaling message, said acceptance message indicating that only said single virtual circuit is provisioned if any of a plurality of switches in a connection path between said device and

said second ATM switch is designed not to support processing of said non-mandatory information element.

Claim 111 (Canceled)

Claim 112 (Previously Presented): The device of claim 110, wherein said first information element comprises a mandatory information element according to said signaling specification used for signaling in said ATM network.

Claim 113 (Previously Presented): The device of claim 112, wherein said signaling specification comprises one of user to network interface (UNI) or network to network interface (NNI).

Claim 114 (Previously Presented): The device of claim 110, wherein each of said plurality of switches in a connection path between said device and said second ATM switch is designed to support said plurality of virtual circuits, said device further comprising:

means for receiving another acceptance message in response to said single signaling message, said another acceptance message indicating that said plurality of switches in a connection path between said device and said second ATM switch have set up said plurality of virtual circuits in response to said single signaling message.

Claim 115 (Previously Presented): The device of claim 114, wherein said plurality of switches accept said plurality of virtual circuits but immediately provision fewer than said plurality of virtual circuits, wherein the specific ones of said plurality of virtual circuits which are set up but not provisioned form a set of inactive virtual circuits, said device further comprising:

means for sending a second signaling message to activate at least one of said set of inactive virtual circuits to said second ATM switch.

Claim 116 (Previously Presented): The device of claim 115, wherein said plurality of virtual circuits is treated as a group of virtual circuits, wherein said first end system and said second end system support a plurality of groups including said group, said device further

comprising means for storing a bundle structure associated with each of said plurality of groups in a memory contained in said memory, wherein said bundle structure stores information identifying the specific plurality of virtual circuits forming the corresponding group.

Claim 117 (Previously Presented): The device of claim 116, further comprising:

means for storing a plurality of call reference structures, wherein each of said plurality of call reference structures maintains the state of a call, wherein signaling messages related to each group are received on a corresponding call; and

means for a plurality of per-VC structures, wherein each per-VC structure stores information related to a plurality of call parameters accepted for a corresponding one of said plurality of virtual circuits.

Claims 118 - 121 (Canceled)

Claim 122 (Currently Amended): A computer readable medium storing one or more sequences of instructions for causing a device to set up virtual circuits between a first ATM switch and a second ATM switch, said plurality of virtual circuits being set up on a ATM network connecting said first ATM switch to said second ATM switch, each of said plurality of virtual circuits terminating at said first ATM switch and said second ATM switch, said device being located in a communication path located between said first ATM switch and said second ATM switch, wherein execution of said one or more sequences of instructions by one or more processors contained in said device causes said device to perform the actions of:

sending on said ATM network to said second ATM switch a single signaling message requesting a plurality of virtual circuits to be set up;

receiving an acceptance message as a response to said single signaling message, said acceptance message indicating that a plurality of switches in a connection path between said first ATM switch and said second ATM switch have set up said plurality of virtual circuits in response to said single signaling message,

wherein said plurality of switches accept said plurality of virtual circuits but immediately provision fewer than said plurality of virtual circuits to said second ATM switch,

wherein the specific ones of said plurality of virtual circuits which are set up but not provisioned form a set of inactive virtual circuits which cannot be used for transporting packets until provisioning is completed; and

sending a second signaling message to complete provisioning of at least one of said set of inactive virtual circuits to said second ATM switch,

wherein said acceptance message is received only if each of said plurality of ATM switches is designed to support processing of a non-mandatory information element which can be ignored according to a signaling specification used in said ATM network, wherein said single signaling message comprises a plurality of information elements, wherein a first information element is designed to request set up of a single virtual circuit comprised in said plurality of virtual circuits, and a second information element in the form of said non-mandatory information element is designed to request set up of a second plurality of virtual circuits comprised in said plurality of virtual circuits,

receiving another acceptance message indicating that only said single virtual circuit is provisioned if any of said plurality of switches in said connection path is designed not to support processing of said second information element in the form of said non-mandatory information element in said single signaling message.

Claim 123 (Canceled)

Claim 124 (Currently Amended): The computer readable medium of claim ~~122~~ ¹²³, wherein said first information element comprises a mandatory information element according to said signaling specification.

Claim 125 - 126 (Canceled)

Claim 127 (Previously Presented): The computer readable medium of claim 122, wherein said fewer than said plurality of virtual circuits corresponds to one virtual circuit

such that only one virtual circuit is provisioned in response to said single signaling message when said acceptance message is received.

Claim 128 (Previously Presented): The computer readable medium of claim 127, wherein said plurality of virtual circuits is treated as a group of virtual circuits, wherein said first end system and said second end system support a plurality of groups including said group, further comprising maintaining a bundle structure associated with each of said plurality of groups, wherein said bundle structure stores information identifying the specific plurality of virtual circuits forming the corresponding group.

Claim 129 (Previously Presented): The computer readable medium of claim 128, further comprising:

maintaining a plurality of call reference structures, wherein each of said plurality of call reference structures maintains the state of a call, wherein signaling messages related to each group are received on a corresponding call; and

maintaining a plurality of per-VC structures, wherein each per-VC structure stores information related to a plurality of call parameters accepted for a corresponding one of said plurality of virtual circuits.

Claims 130 - 134 (Canceled)

Claim 135 (Previously Presented): A computer readable medium storing one or more sequences of instructions for causing a device to support the setting up of virtual circuits between a first ATM switch and a second ATM switch, said plurality of virtual circuits being set up on a ATM network connecting said first ATM switch to said second ATM switch, each of said plurality of virtual circuits terminating at said first ATM switch and said second ATM switch, wherein execution of said one or more sequences of instructions by one or more processors contained in said device causes said device to perform the action of:

receiving from said first ATM switch on said ATM network a single signaling request requesting a plurality of virtual circuits to be set up to said second ATM switch;

sending an acceptance message if said plurality of virtual circuits can be set up between said device and said second ATM switch in response to said single signaling request

alone, wherein said acceptance message is sent as a response to said single signaling request;
and

provisioning fewer than said plurality of virtual circuits to said second end system,
wherein the specific ones of said plurality of virtual circuits which are set up but not
provisioned form a set of inactive virtual circuits which cannot be used for transporting
packets until provisioning is completed.

Claims 136 - 138 (Canceled)

Claim 139 (Previously Presented): The computer readable medium of claim 135,
further comprising:

receiving a second signaling message requesting activation of at least one of said set
of inactive virtual circuits;

completing provisioning of said at least one of said set of inactive virtual circuits; and

sending a completion message in response to said second signaling message, said
completion message indicating said at least one of said set of inactive virtual circuits have
been activated.

Claim 140 (Previously Presented): The computer readable medium of claim 139,
wherein said single signaling message contains a plurality of parameters related to a range
of virtual circuits comprised in said plurality of virtual circuits, further comprising:

storing said plurality of parameters associated with said range of virtual circuits; and

provisioning said range of virtual circuits using said plurality of parameters,

whereby said plurality of parameters are transmitted only once for provisioning said
range of virtual circuits.

Claim 141 (Canceled)

Claim 142 (Previously Presented): A communication system comprising:

a first edge router and a second edge router;

a first asynchronous transfer mode (ATM) switch and a second ATM switch contained
in an ATM network,

wherein said first edge router sends to said first ATM switch a single signaling message requesting a plurality of virtual circuits to be set up to said second edge router,

said single signaling message includes a first information element and a non-mandatory information element according to a signaling protocol, wherein said first information element requests setting up of a first virtual circuit and said non-mandatory information element requests setting up of a second virtual circuit, wherein said first virtual circuit and said second virtual circuit are contained in said plurality of virtual circuits, wherein said non-mandatory information element can be ignored by said first ATM switch and said second ATM switch according to said signaling protocol,

wherein said first ATM switch is designed to set up said plurality of virtual circuits in response to said single signaling message and semantically propagates said single signaling message including said first information element and said and said non-mandatory information element to said second ATM switch,

wherein said second ATM switch receives said single signaling message,

if said second ATM switch supports processing of said non-mandatory information element, said second ATM switch propagates said single signaling message semantically to said second edge router, said second ATM switch receiving a first acceptance message from said second edge router indicating said plurality of virtual circuits are provisioned to said second edge router, and propagating said first acceptance message as a response to said single signaling message to said first edge router,

if said second ATM switch does not support processing of said non-mandatory information element, said second ATM switch ignoring said non-mandatory information element and processing said first information element to provision said first virtual circuit, said second ATM switch sending a second acceptance message as a response to said single signaling message indicating that only said first virtual circuit has been provisioned in response to said single signaling message.

Claim 143 (Currently Amended): The communication system of claim 142, wherein said second ATM switch supports setting up of said plurality of virtual circuits including processing of said non-mandatory information element in response to said single signaling message,

said second ATM switch provisioning fewer than said plurality of virtual circuits to said second edge router, wherein said first acceptance message indicates that fewer than said plurality of virtual circuits have been provisioned and all of said plurality of virtual circuits have been accepted,

wherein the specific ones of said plurality of virtual circuits which are set up but not provisioned form a set of inactive virtual circuits,

wherein said first edge router sends an another signaling message to said second ATM device via said first ATM device requesting activation of at least one of said set of inactive virtual circuits to said second edge router,

said second ATM device activating said at least one of said set of inactive virtual circuits to said edge router and sending a second acceptance message ~~indication~~ indicating that said at least one of said set of inactive virtual circuits is provisioned.